

Integrated Ocean Architecture Project: Background

- The long-term need of the DoD's Ocean Executive Agent (OEA) is for the development of a virtual maritime environment within which diverse domain processes can interact to support Naval operations such as Operational Maneuver From The Sea (OMFTS)
- The OEA has been sponsoring an Integrated Ocean Project (IOP) to develop the suite of models that produce oceanic representation in different domains, but has lacked an architecture that can seamlessly integrate these models.

Integrated Ocean Architecture: Background (Cont.)

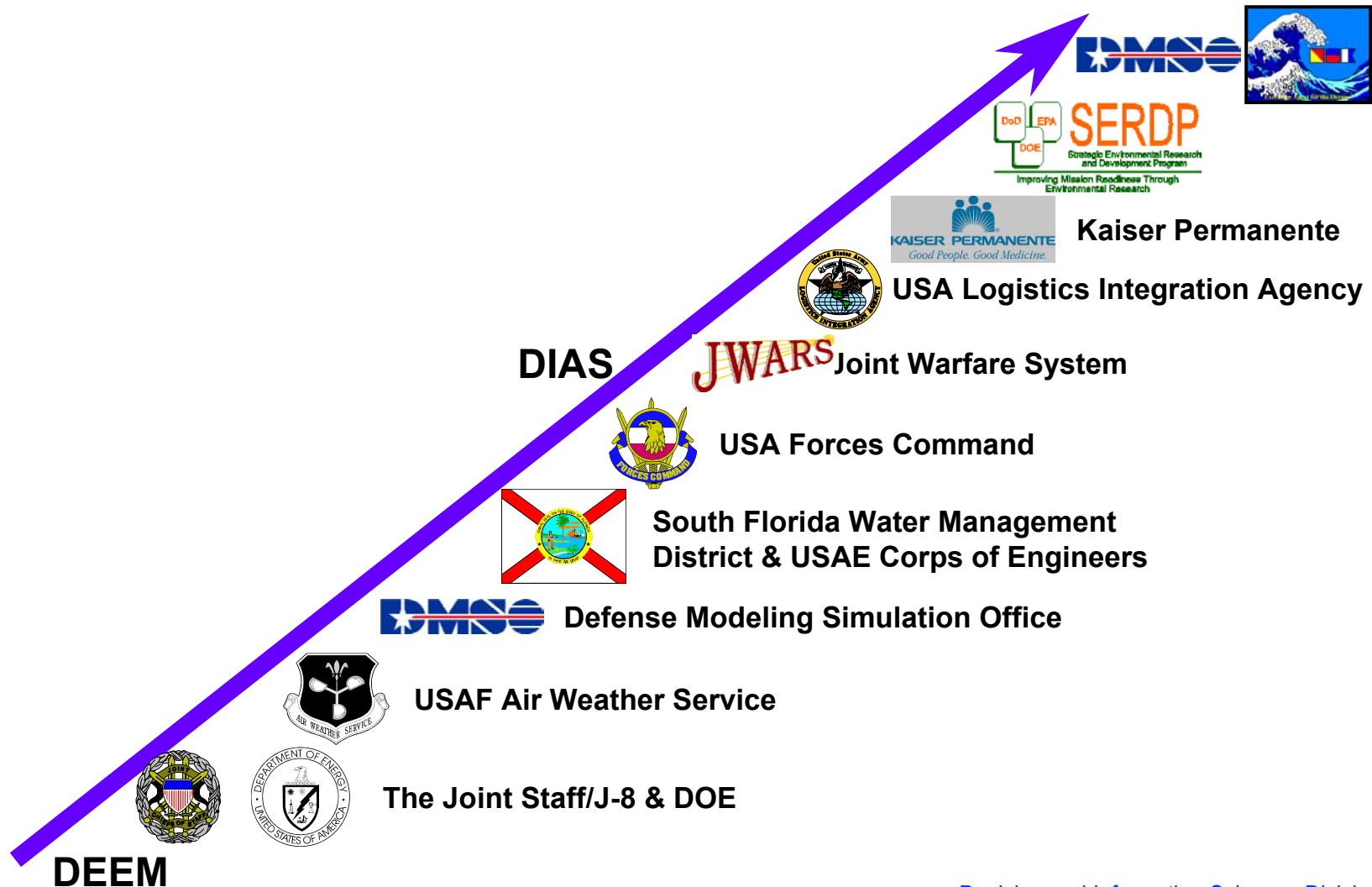
- In FY99, Argonne was funded to use DIAS to develop the Integrated Ocean Architecture (IOA)
- IOA partners include Naval Research Laboratory Stennis Space Center and USA COE Waterways Experiment Station
- IOA was developed as a two year program:
 - The FY99 focus was to produce surf zone forecasts for the selection of amphibious landing areas
 - The FY00 focus was intended to extend the IOA to a full ocean representation and to begin the transition to an operational system

Integrated Ocean Architecture: Background (Cont.)

- The IOP suite of ocean models, supplied by NRL:
 - WAM - oceanic wind-driven wave generation and propagation
 - ADCIRC* - tide and wind effects on water surface elevation
 - STWAVE - nearshore wave propagation (for simple shorelines)
 - REF/DIF* - nearshore wave propagation (for complex shorelines)
 - SURF3.0 - surf zone wave characteristics

*Planned for integration into the IOA in FY00

DIAS Evolution and Sponsor Applications



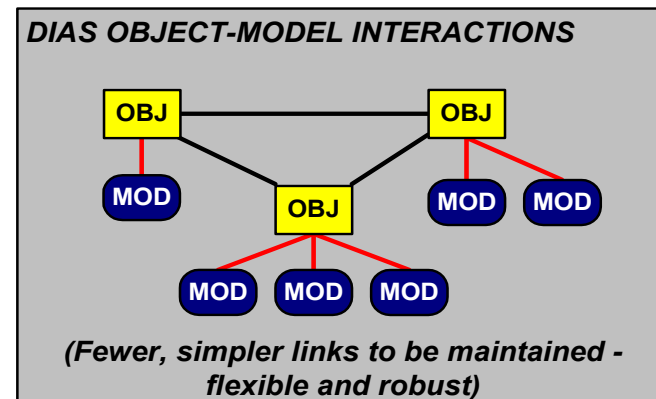
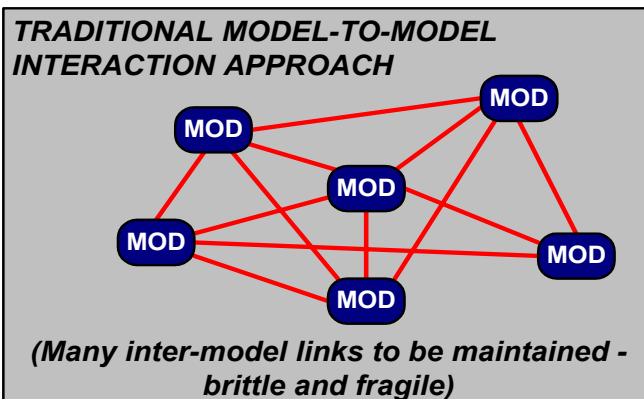
DIAS Facilitates Building and Maintaining Complex Multidisciplinary Simulations

- DIAS is an object-based software *framework* for modeling and simulation
- The DIAS software infrastructure allows many disparate simulation models and other applications to work together harmoniously to address a complex problem
- Main components of a DIAS simulation:
 - Software objects that represent the real-world entities that comprise the problem space
 - Simulation models and other applications that express the dynamic behaviors of the domain entities. Existing "legacy" models in virtually any software language can be used in complex DIAS simulations

New Web Site: <http://www.dis.anl.gov/DIAS>

The DIAS Framework Is Flexible and Extensible

- In DIAS, models communicate only with domain objects, never directly with each other - making it easier to add or swap alternative models in and out without re-coding



- DIAS objects are adjustable to the context of the problem:
 - objects have flexible, variable attribute lists -- can be tailored to need
 - abstraction of object behaviors -- objects don't "know" about model internals, so objects are simpler and more reusable

A Large and Growing DIAS Object Library Supports Construction of New Simulation Systems

Object Classes in DIAS Object Library (Not an exhaustive list)

Ephemeris
Atmosphere

Hydrosphere
GroundWater
SurfaceWater
HydroLayer
WaterBody
Stream
ExternalStream
Pool
Offshore
Nearshore
SurfZone
ExternalPool
Shore

AreaOfInterest
AvenueOfApproach

EarthSurface

Cover
SoilCover
WaterCover
SnowIceCover
SurfaceCover
Developed
Bare
Wetland
Grassland
Forest
Cane
Plantation
Cropland
Vineyard
Scrub
Microterrain

TransportNet
TransportLink
TransportArc
AirArc
RailArc
RoadArc
TransportNexus
Airfield
Railyard
HydroNexus
CatchmentNexus
OpenWaterNexus
TransportNode
TransportJunction
AirJunction
RailJunction
RoadJunction
HydroJunction
TransportBoundary
HydroBoundary
Littoral

Artifact
Structure
Building
Vehicle
LandVehicle

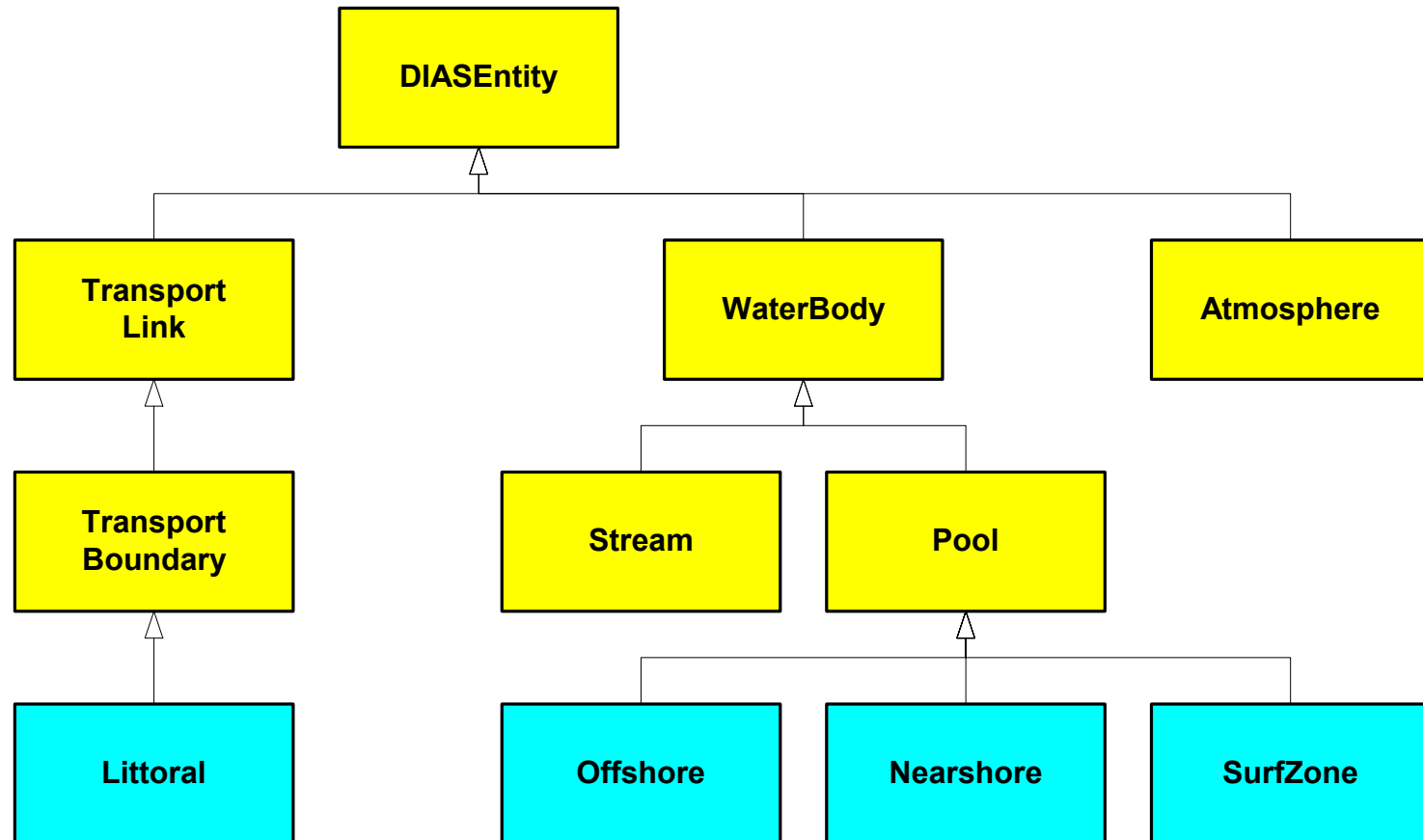
ArcPathway
Bridge, BridgeSpan
Ferry
Ford
Tunnel

NodeQualifier
Constriction
DropGateRail
DropGateRoad
HydroStructure
HydroCulvert
HydroGatedCulvert
HydroGatedSpillway
HydroPump
HydroWell
HydroDrain
Levee
LeveeSection

Person
Physiology
PhysiologicalSystem

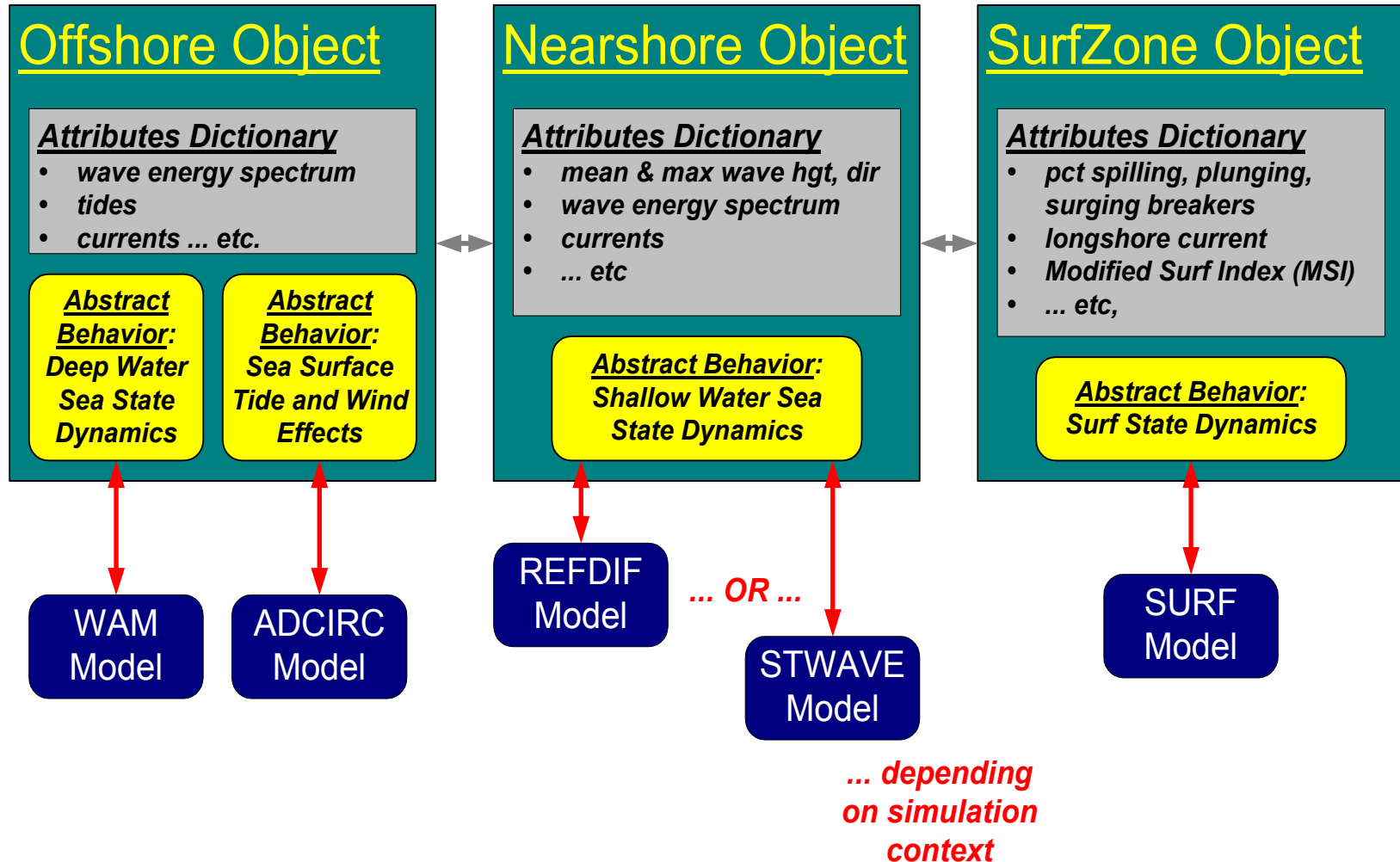
Organization
MedicalDepartment
Family

The IOA Reuses Many Objects from the DIAS Object Library

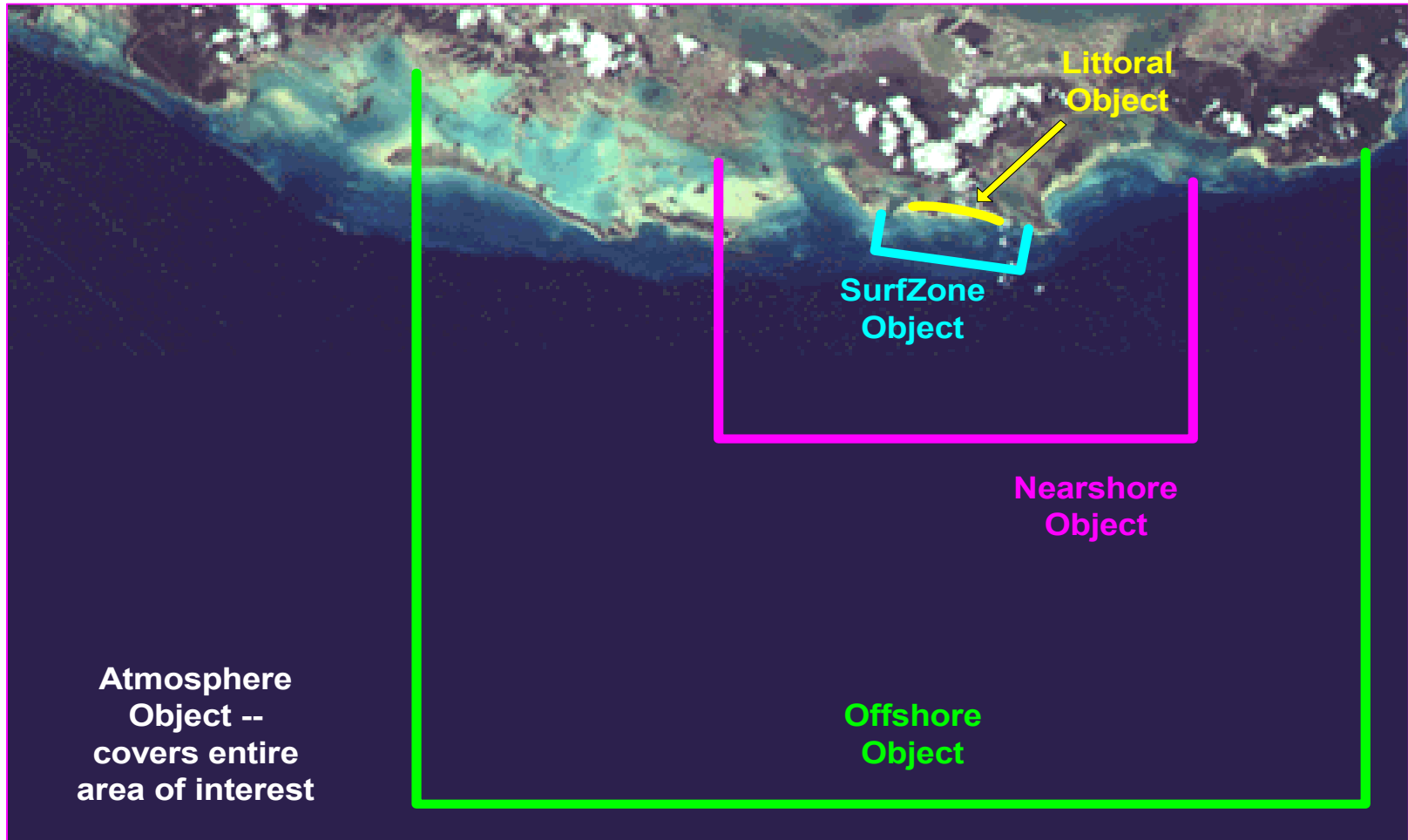


(Reused objects in yellow and new objects in blue)

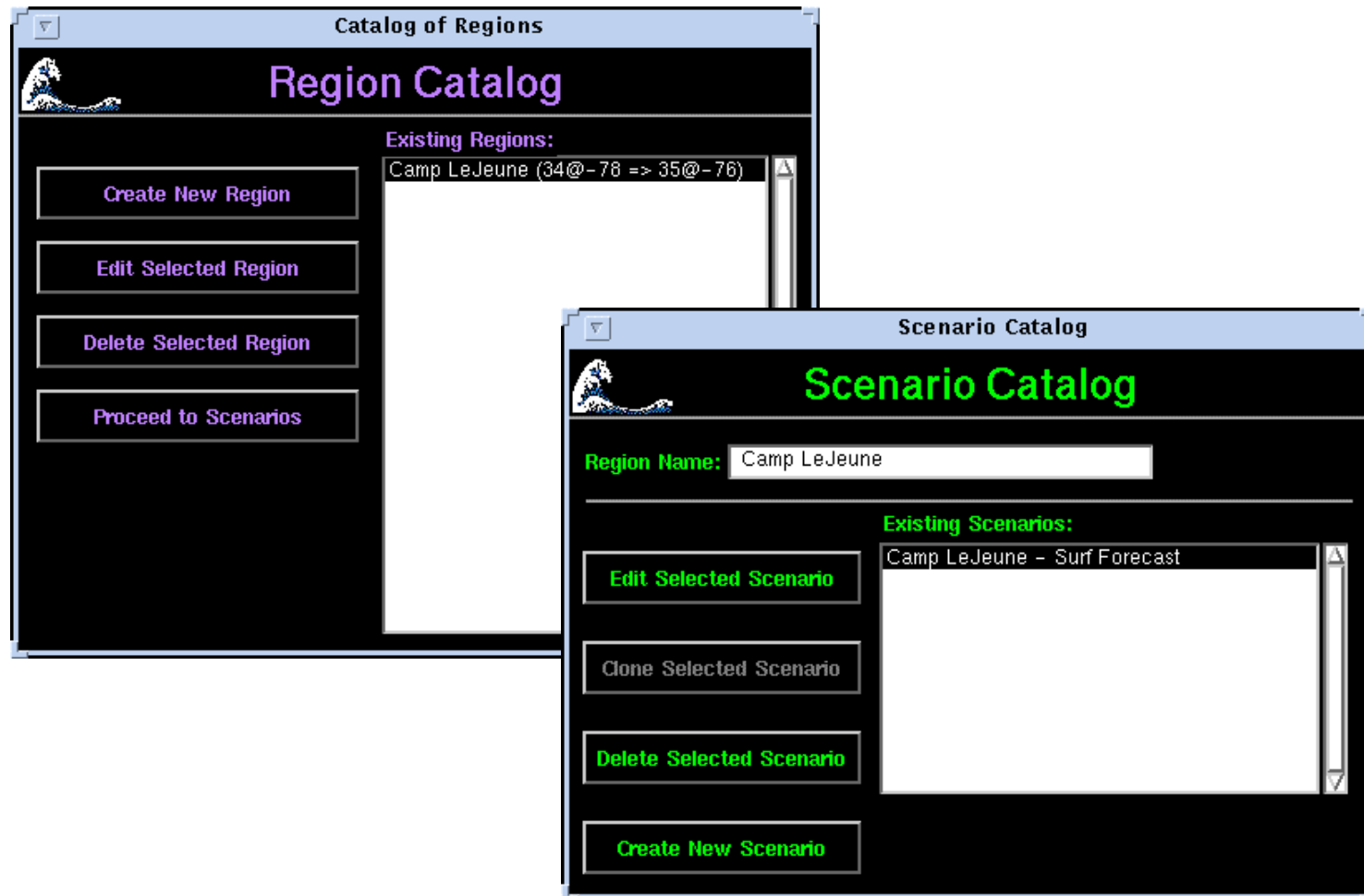
DIAS Ocean Object - Model Interactions



Integrated Ocean Project: Example of Spatial Layout of DIAS Domain Objects



Selecting a Region and Scenario



A “Scenario Executive” Controls the Setting Up of Model Inputs

IOP Simulation – Camp LeJeune – Surf Forecast

Scenario Executive

Region Name: Camp LeJeune

Scenario Name: Camp LeJeune – Surf Forec

Simulation Start Time: 9/1/99 12:00 AM

Simulation End Time: 10/15/99 12:00 AM

Scenario Description:
This scenario utilizes WAM, STWAVE, and SURF to provide a surf forecast at Camp LeJeune

Model Input Parameters

STWAVE Model **SURF Model** **WAM Model**

WAM: Model Inputs

Computational Grids
Before any of the input data can be edited, at least one computational grid must be defined. To define or edit computational grids, click on the edit

WAM Model Period
Start Date: 9/1/99 12:00 AM
End Date: 9/15/99 12:00 AM
Cancel Update

Model Input Data
WAM-Preset WAM-Preproc WAM Model
WAM Winds Topography WAM Currents Data Problems

Execute WAM Execute STWAVE Execute SURF

View Data Save

IOP Simulation – Camp LeJeune – Surf Forecast

Scenario Executive

Region Name: Camp LeJeune

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Model Input Parameters

STWAVE Model **SURF Model** **WAM Model**

STWAVE: Model Inputs

STWAVE Model Parameters:
Use the buttons below to modify the inputs to STWAVE. Certain parameters must be set before other parameters can be set. The control parameters cannot be set until the bathymetry has been set. This ensures that the special output points selected are within the bathymetry grid. The dates cannot be chosen until the wave spectra and winds have been chosen. This ensures that all data necessary to run for a particular time is all there.

Control Parameters **Bathymetry** **Dates**
Wave Spectra **Winds** **Nearshore Currents**
Tides

Execute WAM Execute STWAVE Execute SURF

View Data Save

IOA Supports Easy Data Entry and Data Checking Tools

WAM Model Data Source: Bathymetry

WAM: Bathymetry

Defined Grids

- Atlantic West
 - Camp LeJeune

Data Entry Mode

Specify From File

Reset Data Enter Data Done

Data Input Inconsistencies

WAM Input Relationship Errors

Select Grid:

- Atlantic West
 - Camp LeJeune

Problems

- CFLP Criteria not fulfilled
- CFLP Criteria not fulfilled

Problem Description

CFLP is > 1.0
The input values of:
IDELPRO: 1200 seconds
FR(1) 0.0333333 and
XDELLO: 0.1 degrees (8634.96 meters)
yield a value of 3.2533.

Done

IOA Supports Easy Data Entry and Data Checking Tools

Unlabeled Canvas

SURF Control Parameters

Landing Zone Name:

Use Straight Coast: ☒ True ☐ False

Detailed Output: ☒ True ☐ False

Starting Depth (ft):

Output Interval (ft):

Heading Toward Beach (Degrees from North):

Refraction Parameters

SURF: Refraction

Data Entry Mode

Wave Spectrum Selection

Select Wave Spectrum

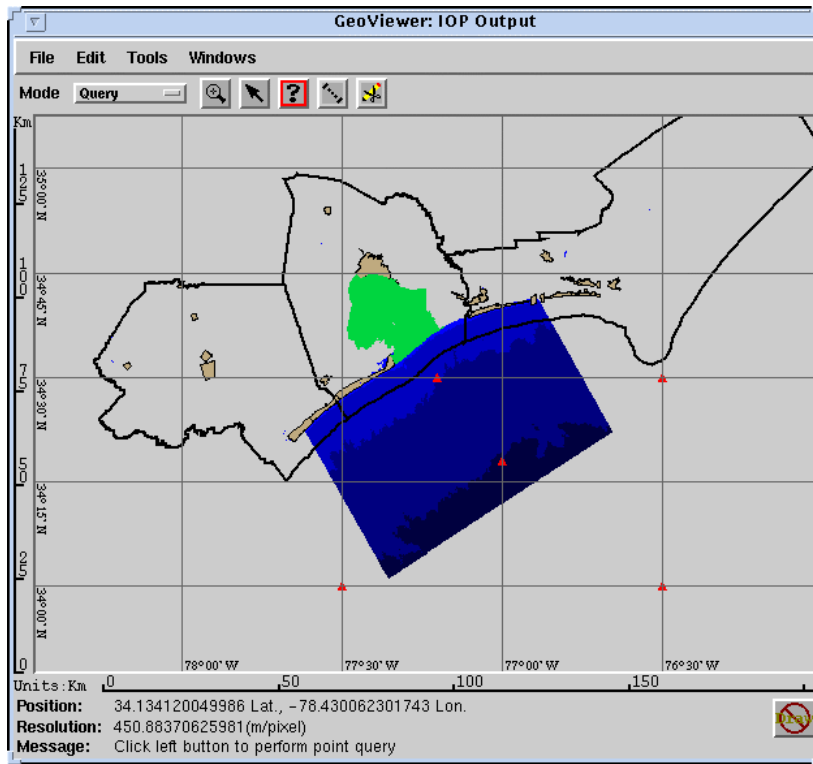
Available Wave Spectra Points

Available Wave Spectra	Points
STWAVE Generated Wave	34.349212406715@-
	34.400306120611@-
	34.549178478377@-
	34.544497047076@-

Frequencies

0.0333333
0.0366667
0.0403333
0.0443667
0.0488033
0.0536837
0.059052

IOA Uses Argonne's GeoViewer for Display and Manipulation



Tabular Display of Wave Spectra Points

Graphical Display of Wave Spectra Points

Wave Spectrum

STWAVE Wave Spectrum

	245	250	255	260	
0.0333	0.0000	0.0000	0.0000	0.0000	0.01
0.0367	0.0000	0.0000	0.0000	0.0000	0.01
0.0403	0.0000	0.0000	0.0000	0.0000	0.01
0.0444	0.0000	0.0000	0.0000	0.0000	0.01
0.0488	0.0000	0.0000	0.0000	0.0000	0.01
0.0537	0.0000	0.0000	0.0000	0.0000	0.01
0.0591	0.0000	0.0000	0.0010	0.0030	0.01
0.0650	0.0000	0.0010	0.0040	0.0130	0.01
0.0715	0.0000	0.0010	0.0040	0.0140	0.01
0.0786	0.0000	0.0010	0.0040	0.0130	0.01
0.0865	0.0000	0.0010	0.0060	0.0180	0.01
0.0951	0.0000	0.0010	0.0070	0.0200	0.01
0.1046	0.0000	0.0010	0.0070	0.0190	0.01
0.1151	0.0000	0.0010	0.0070	0.0180	0.01
0.1266	0.0000	0.0020	0.0100	0.0210	0.01
0.1392	0.0000	0.0030	0.0160	0.0240	0.01
0.1532	0.0000	0.0060	0.0220	0.0230	0.01